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Increasing Inequality and Voting for Basic Income: Could Gender Inequality Worsen?

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This paper examines the link between political support for basic income funded by linear income taxation and income inequality by household and gender. We develop a model with an increasingly right-skewed distribution of skill across households and a gender wage gap within households. Household preference for basic income decreases as skill level increases and female labour supply decreases with time spent rearing children. Majority voting supports the basic income scheme as mean relative to median household skill increases. Household fertility and skill level are inversely related under the scheme. An increase in the marginal tax rate to fund required government revenue could excacerbate gender inequality by reducing female labour supply. Quantitative illustrations suggest that the recent peak in the mean to median wage gap would provide voting support for basic income from the majority of households in the United States. Basic income of $12,000 conditional on below-median wages would increase government spending by 10.8% which, if funded by progressive income taxation, could reduce the adverse effects on gender inequality.

Keywords

Basic income, Taxation, Gender inequality, Fertility

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Increasing inequality and voting for basic income: Could gender inequality worsen?

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Abstract

This paper examines the link between political support for basic income funded by linear income taxation and income inequality by household and gender. We develop a model with an increasingly right-skewed distribution of skill across households and a gender wage gap within households. Household preference for basic income decreases as skill level increases and female labour supply decreases with time spent rearing children. Majority voting supports the basic income scheme as mean relative to median household skill increases. Household fertility and skill level are inversely related under the scheme. An increase in the marginal tax rate to fund required government revenue could excacerbate gender inequality by reducing female labour supply. Quantitative illustrations suggest that the recent peak in the mean to median wage gap would provide voting support for basic income from the majority of households in the United States. Basic income of $12,000 conditional on below-median wages would increase government spending by 10.8% which, if funded by progressive income taxation, could reduce the adverse effects on gender inequality.

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1. Introduction

There has been a resurgence of political interest in basic income as a means to address income inequality which has increased across households and persists by gender within households. The basic income scheme pays individuals equal and regular cash transfers irrespective of employment and is funded by linear taxation of income (Atkinson, 1996; 2015). This paper explores the interplay between income inequality, household labour supply and voting for basic income and how gender inequality may worsen rather than improve under the scheme.

An emerging debate considers the implications of basic income for gender equality. On the one hand, universal and unconditional basic income avoids the stigma costs, welfare traps and administrative costs (van Parijs, 2004) and paternalistic implementation practices (Cookson, 2019) of means-tested transfers for women. On the other hand, basic income could discourage female labour supply outside the home and reinforce gender inequality in male-breadwinner households (Gheaus, 2008). We contribute to this debate by analysing the effect on maternal labour supply of an increase in the marginal tax rate under the basic income scheme.

Consistent with trends in the size of government (Makin et al., 2019), we consider an increase in required government revenue relative to household wages which would imply an increase in the marginal tax rate to fund basic income (van Parijs and Vanderborght, 2017). Suzuki (2021) finds that an increase in the marginal tax rate under a basic income scheme proposed for New Zealand would increase inequality across households because poor households reduce labour supply more than rich households. A priori reasoning suggests that an increase in the marginal tax rate to fund basic income could increase inequality within households when women earn less and reduce labour supply more than men.

Empirical studies find that basic income affects household fertility and female labour supply incentives. Evidence for the Alaska Permanent Fund Dividend suggests that basic income increases household fertility (Yonzan et al., 2020). Evidence for Germany suggests that basic income reduces the labour supply of women in heterosexual couples due to an increase in the marginal tax rate under government budget neutrality (Hortstschraer et al., 2010). The model developed in this paper incorporate these themes.

The theoretical analysis in this paper addresses two questions. First, how could an increase in income inequality across households lead to majority voting support for a basic income scheme? Second, what are the implications for female labour supply within households of an increase in the marginal tax rate under the scheme? These questions have relevance for governments that face political support for basic income and seek to reduce gender inequality.

This paper develops a model where skill is unequally distributed across households but does not differ according to gender. Women's wages are less than male wages despite the same skill level and female labour supply decreases with time spent rearing children. This is consistent with evidence that the gender wage gap reflects discrimination and female disadvantage (Tisdell, 2019) and that the gender income gap persists due to a child penalty (Kleven et al., 2020). In our model, each household chooses female labour supply and the preferred marginal tax rate. Majority voting determines whether the economy-wide linear income tax schedule funds basic income.

The model builds on a theoretical literature that links unequal skill distribution to the properties of a linear income tax schedule determined by majority voting, although our focus on basic income and approach to household labour supply differs. Roberts (1977) shows that if incomes are ordered by skill level and thus independent of the tax schedule, then a majority voting equilibrium (MVE) exists where skill level and preferred marginal income tax rate are inversely related. Romer (1975) finds that when the median skill level is high, even if below the mean in a right-skewed distribution, the MVE linear income tax schedule comprises the lowest marginal tax rate with a lump sum tax and is therefore average rate regressive. Meltzer and Richard (1981) show that a rise in mean relative to median skill in a right-skewed distribution increases the MVE marginal income tax rate to fund an increase in government size measured by the share of income redistributed.

In the existing literature, household labour supply is endogenously determined by demand for leisure and overlooks time spent rearing children. Seminal endogenous fertility models predict that demand for children falls with a rise in female relative wages and hence the opportunity cost of maternal time (Galor and Weil, 1996) and a rise in the fraction of skilled households who have fewer children than unskilled households (Kimura and Yasui, 2007). These models attribute the gap between male and female wages to innate differences in skill and lower fertility of high skill households to time spent acquiring skill. Our model relaxes these assumptions and allows for competing substitution and income effects of after-tax male and female wages on demand for children.

We analyse whether a rise in mean relative to median skill increases the MVE marginal income tax rate to fund basic income. The key mechanism can be explained intuitively. An increase in mean skill and taxable average income means that the government can afford basic income and low median skill means that majority voting supports basic income. Comparative static analysis shows how an increase in required government revenue could increase the marginal tax rate and discourage female labour supply. Quantitative illustrations of the model for the United States (US) demonstrate whether the mean to median wage gap is sufficient to provide majority support for basic income and how basic income conditional on skill reduces the additional revenue requirement.

Optimal tax theory literature, founded in the works of Mirrlees (1971) and Sheshinski (1972) on nonlinear and linear income taxation, respectively, analyses the equity and efficiency implications of taxation to fund transfers. A key result is that optimal nonlinear taxation is Pareto superior to linear taxation for any given revenue requirement (Boadway, 1998). In contrast, the model in this paper contributes to an alternative tax theory literature where the linear income tax schedule is the outcome of a majority voting equilibrium. As median voter theory applies to unidimensional policies, the results do not carry over to the case of nonlinear income taxation. We therefore discuss the welfare implications of basic income conditional on skill funded under the present US income tax policy.

2. The model

Our model links the rightward skew of skill distribution across households and female relative wages within households to whether majority voting supports a marginal tax rate to fund basic income under a linear income tax schedule. Each household is headed by a man and woman with joint consumption and utility. The derivation of a majority voting equilibrium comprises three steps. First, the household chooses the optimal number of children and female labour supply for a given income tax schedule. Second, each household chooses their most preferred income tax schedule that maximises after-tax indirect utility. Third, we show that household preferences are a single-peaked function of the marginal tax rate, which enables aggregation of preferences into an economy-wide income tax schedule.

2.1 Skill distribution, gender wage gap and the tax function

Let x denote the innate skill of an individual, which is a measure of labour productivity and is unobservable to the government. Skill ranges from the lowest value x_0 to the highest value X. $F(x)$ is the cumulative distribution function of inherent skill levels in the population, which is differentiable where $\frac{dF(x)}{dx} = f(x) > 0$ for $0 < x_0 \leq x < X$. We also have $\int_{x_0}^{X} f(x)\,dx = \int_{x_0}^{X} dF(x) = 1$.

Although we allow innate skill to differ across households, we assume no difference in innate skill between men and women. A gender wage gap exists because women's wages do not reflect their true labour productivity. Men are paid their productivity, while women are paid less than their productivity. The male wage is $w_m = x$ and the female wage is $w_f = \beta x$, where $\beta \in (0,1)$ is the female wage relative to the male wage.

Each man and woman is endowed with a unit of time. The household allocates a portion of the woman's time endowment to rearing children as the opportunity cost in terms of foregone wages is lower for women than it is for men. Women spend zn of their unit time endowment rearing children where $z \in (0,1)$ is time per child and n is number of children. Male labour supply is 1 and female labour supply to the paid workforce is $l = (1 - zn)$. Before-tax household income y is observable and is the sum of male gross income x, and female gross income $\beta x l$. The household's choice of n, which depends on β and x, determines l. Thus, $y(\beta, x) = x(1 + \beta l(\beta, x))$.

The tax function is linear in before-tax income, $T(y) = ty - b$, where $t \in (0, 1)$ is a constant marginal tax rate and $b > (< 0)$ is a lump-sum transfer (tax). If $b > 0$, the average tax rate, $\frac{T(y)}{y} = t - \frac{b}{y}$, increases as gross income increases and is therefore progressive.

The household budget constraint is given by

$$y^d = c = (1 - t) x (1 + \beta (1 - zn)) + b \qquad (1)$$

where y^d is after-tax household income and c is household consumption. Under a basic income scheme, each man and woman would receive $b/2 > 0$ regardless of household income.

2.2. Household fertility and labour supply

Each household has utility of the form

$$U(c, n) = c^{\gamma} n^{1-\gamma} \qquad (2)$$

where $\gamma \in (0, 1)$ captures the relative value placed on children. The household maximises (2) subject to (1), for given tax parameters (b, t). The optimisation problem yields fertility and female labour supply

$$n(\beta, x, b, t) = \frac{1-\gamma}{z\beta}\left[(1 + \beta) + \frac{b}{(1-t)x}\right] \qquad (3a)$$

$$l(\beta, x, b, t) = \gamma - \frac{(1-\gamma)}{\beta}\left[1 + \frac{b}{(1-t)x}\right] \qquad (3b)$$

with corresponding household income before and after tax

$$y(\beta, x, b, t) = \gamma(1 + \beta)x - \frac{(1-\gamma)b}{(1-t)} \qquad (4a)$$

$$y^d(\beta, x, b, t) = c(\beta, x, b, t) = (1-t)\gamma(1+\beta)x + \gamma b \qquad (4b)$$

expressed in terms of the household's innate skill level x.

By equations (3a) and (3b), female labour supply is increasing in β when $-b < (1-t)\,x$ which necessarily holds for $b > 0$ and holds for $b < 0$ provided the lump-sum tax is less than income net of marginal tax. Intuitively, higher female relative wages increases the opportunity cost of women's time spent rearing children. The effect of innate skill level x on fertility and female labour supply depends on $b \gtrless 0$, that is, whether the average tax rate is progressive or regressive. By equations (4a) and (4b), household income both before and after tax increases with innate skill level x and thus the ranking of household income is preserved.

For the purpose of analysing the preferred income tax schedule, we express the household's maximised utility in terms of parameters (b,t). The indirect utility for a household with skill level x is

$$V(\beta, x, b, t) = \delta \frac{[(1-t)(1+\beta)\,x + b]}{[z\beta(1-t)\,x]^{1-\gamma}} \tag{5}$$

where $\delta = \gamma^{\gamma}(1-\gamma)^{1-\gamma}$. By equation (5), indirect utility is increasing in female relative wages β and the household's skill level x.

2.3. The basic income and tax possibility frontier

The government is required to raise revenue per household of $G > 0$. Since we are focusing on basic income and the marginal tax rate, we are not concerned with the purpose for which this revenue is required. However, we are interested in how the choice of parameters (b,t) is influenced by the level of required revenue.

The government's revenue requirement imposes a constraint on the tax function

$$t\int_{x_0}^{X} y(\beta, x, b, t)\,dF(x) = b + G \tag{6}$$

whereby total marginal tax revenue excluding basic income $(b > 0)$ or including lump-sum tax $(b < 0)$ must equal G. When every household participates in the labour force, $\int_{x_0}^{X} x dF(x) = \bar{x}$ where $\bar{x}$ is the mean skill level of the population.

Substituting from equation (4a), $\int_{x_0}^{X} dF(x) = 1$ and $\int_{x_0}^{X} xdF(x) = \bar{x}$ in equation (6), the tax possibility frontier is

$$b = \frac{(1-t)(\gamma(1+\beta)t\bar{x} - G)}{(1-\gamma t)} \tag{7}$$

which implies that for each permissible value of t, there is a unique solution $b = b(t) \gtrless 0$ if $t \gtrless \frac{G}{\gamma(1+\beta)\bar{x}}$. Thus, for a given level of G, we may treat the set of alternative parameters (b, t) as effectively one-dimensional (t).

The government revenue requirement must be less than national income. That is, $G < \int_{x_0}^{X} y(\beta, x, b, t)\, dF(x)$. Since female labour supply $l(x) \in (0,1)$ for all x, it follows that $\int_{x_0}^{X} y(\beta, x, b, t)\, dF(x) = \int_{x_0}^{X} x[1 + \beta l(x)]\, dF(x) < (1+\beta)\int_{x_0}^{X} xdF(x)$ where $xdF(x) = \bar{x}$. Hence, we must have $G < (1+\beta)\bar{x}$.

Referring to equation (1), if $b < 0$ is chosen and $-b > (1-t)x(1+\beta)$ then the household would face negative consumption even if women were to allocate all of their time endowment to the paid workforce. The simplest way to avoid this is to impose restrictions on tax parameters that ensure that after-tax income is non-negative for all households. We therefore assume $-b \leq (1-t)(1+\beta)x_0$ which together with equation (7) gives

$$1 > t \geq \frac{G - (1+\beta)x_0}{\gamma(1+\beta)(\bar{x} - x_0)} \tag{8}$$

where the lowest permissible marginal tax rate is $\tilde{t} = \frac{G-(1+\beta)x_0}{\gamma(1+\beta)(\bar{x}-x_0)}$.

3. Voting

A household with given skill level x chooses the most preferred $(b(t), t)$ of all permissible parameters. Whether household preferences over the parameters are single-peaked will inform our analysis of a majority voting equilibrium.

3.1. Single-peaked household preferences

The household chooses $(b(t), t)$ to maximise indirect utility $V(\beta, x, b, t)$ given by equation (5) subject to the constraints given by (7) and (8). If the second constraint

(8) does not bind $\left(t > \tilde{t}\right)$, then the household's optimisation problem is

$$\max_t V(\beta, x, t) = \delta \frac{(1-t)^{\gamma}\left[(1+\beta)x - G + \gamma(1+\beta)t(\bar{x}-x)\right]}{(z\beta x)^{1-\gamma}(1-\gamma t)} \tag{9}$$

where we have substituted equation (7) in equation (5). The first order optimality condition yields

$$\frac{(1-\gamma)t^*}{(1-\gamma t^*)^2} = \frac{\bar{x}-x}{\bar{x}-\frac{G}{(1+\beta)}} \tag{10}$$

where $t^* = t^*(x)$ is the solution to equation (10). Implicit differentiation of equation (10) gives

$$\frac{\partial t^*(x)}{\partial x} = -\frac{(1-\gamma t^*)^3}{\left(\bar{x}-\frac{G}{(1+\beta)}\right)(1-\gamma)(1+\gamma t^*)} < 0 \tag{11}$$

where $G < (1+\beta)\bar{x} \Rightarrow \frac{\partial t^*(x)}{\partial x} < 0$.

By equation (11), the preferred income tax rate decreases as the household's skill level x increases when constraint (8) does not bind, $\left(t > \tilde{t}\right)$. This implies that there is a sufficiently high level of skill $(\tilde{x})$ such that the second constraint (8) binds $\left(t = \tilde{t}\right)$. In this case, the household's preferred marginal income tax rate is

$$t^* = \tilde{t} = \frac{G-(1+\beta)x_0}{\gamma(1+\beta)(\bar{x}-x_0)} \tag{12}$$

where $\tilde{t}$ is the lowest permissible marginal income tax rate.

Substituting $t^* = \tilde{t}$ from equation (12) and $x = \tilde{x}$ in equation (10), the threshold skill level is

$$\tilde{x} = \bar{x} - \frac{(1-\gamma)}{\gamma}\frac{(G-(1+\beta)x_0)(\bar{x}-x_0)}{\bar{x}(1+\beta)-G} \tag{13}$$

where $\tilde{x} < \bar{x}$ if $G > (1+\beta)x_0$. From equations (10) and (12)

$$t^*(x) = \begin{cases} \text{solution to (10)} & \text{if} \quad x \leq \tilde{x} \\ \frac{G-(1+\beta)x_0}{\gamma(1+\beta)(\bar{x}-x_0)} & \text{if} \quad x > \tilde{x} \end{cases} \tag{14}$$

where, by equation (11), $\partial t^*(x)/\partial x < 0$ if $x \leq \tilde{x}$, which says that less skilled households will prefer a higher marginal income tax rate than more skilled households.

The preferred marginal income tax rate of a household is bounded below by the lowest permissible marginal income tax rate, $\tilde{t}$. The following proposition summarises this finding.

Proposition 1 *The household's preferred marginal income tax rate decreases as the household's innate productivity level increases and has a lower bound.*

Intuitively, each household knows the trade-off between the marginal tax rate t and lump sum component $b(t)$ of the income tax schedule, as given by the tax possibility frontier. For a given mean skill level of the population $\bar{x}$, $b(t) > 0$ would require a higher t to fund both basic income and required government revenue G. A household with low innate skill x, and thus low earnings capacity, maximises well-being by receiving basic income $b(t) > 0$ and paying a higher marginal tax rate t on gross income. A household with high x would prefer to pay a lower marginal tax rate t and a lump-tax $b(t) < 0$.

3.2. Majority voting and basic income

By equation (14), preferences over the permissible range of parameters $(b(t), t)$ are single-peaked. Single-peaked preferences assures us that there will be a chosen value of t, denoted by $\breve{t}$, that is stable against the rule of the majority. That is, $\breve{t} = \hat{t} = t^*(\hat{x})$ cannot be defeated by an absolute majority in competition with a higher or lower permissible tax rate.

If the skill distribution is skewed rightward where the tail stretches toward high skill levels, the median skill level is less than the mean skill level $(\hat{x} < \bar{x})$. We may reasonably expect that a right-skewed skill distribution corresponds to much of the real world. By (13), $\tilde{x} < \bar{x}$ given the reasonable assumption that $G > (1+\beta)\, x_0$. Two possibilities arise. If the majority of the population have skill level above the threshold skill level $(\hat{x} > \tilde{x})$ then $\tilde{x} < \hat{x} < \bar{x}$. If the majority of the population have skill level below the threshold skill level $(\hat{x} < \tilde{x})$ then $\hat{x} < \tilde{x} < \bar{x}$.

Consider the case where the median skill level is below the mean but above the threshold level $(\tilde{x} < \hat{x} < \bar{x})$. By equation (14), the majority voting equilibrium value of t is $\breve{t} = \hat{t} = t^*(\hat{x}) = \frac{G-(1+\beta)x_0}{\gamma(1+\beta)(\bar{x}-x_0)}$. The tax possibility frontier restriction $G < (1+\beta)\bar{x} \Leftrightarrow \frac{G-(1+\beta)x_0}{\gamma(1+\beta)(\bar{x}-x_0)} < \frac{G}{\gamma(1+\beta)\bar{x}}$. Thus, $\breve{t} = \hat{t} < \frac{G}{\gamma(1+\beta)\bar{x}}$. Referring to equation (7), $\hat{t} < \frac{G}{\gamma(1+\beta)\bar{x}}$, together with $t < 1 < \frac{1}{\gamma}$, imply $b(\breve{t}) = b(\hat{t}) < 0$. A lump-sum tax is therefore selected by majority voting.

Now consider the case where the median skill level is below the threshold level which in turn is below the mean skill level ($\hat{x} < \tilde{x} < \bar{x}$). By equation (14), the majority voting equilibrium value of t is $\breve{t} = \hat{t} = t^*(\hat{x})$ which is the solution to

$$\frac{(1-\gamma)\hat{t}}{\left(1-\gamma\hat{t}\right)^2} = \frac{\bar{x}-\hat{x}}{\bar{x}-\frac{G}{(1+\beta)}} \tag{15}$$

where the properties of the income tax schedule are determined by

$$\breve{t} = \hat{t} \lesseqgtr \frac{G}{\gamma(1+\beta)\bar{x}} \Leftrightarrow \frac{(1-\gamma)\hat{t}}{\left(1-\gamma\hat{t}\right)^2} \lesseqgtr \frac{(1-\gamma)\frac{G}{\gamma(1+\beta)\bar{x}}}{\left(1-\frac{G}{(1+\beta)\bar{x}}\right)^2} \tag{16}$$

Substituting from equation (15) for $(1-\gamma)\hat{t}/\left(1-\gamma\hat{t}\right)^2$ in (16) gives

$$\breve{t} = \hat{t} \lesseqgtr \frac{G}{\gamma(1+\beta)\bar{x}} \Leftrightarrow \hat{x} \gtreqless \alpha\bar{x} \tag{17}$$

where $\alpha = \left(\gamma\bar{x} - \frac{G}{(1+\beta)}\right) \Big/ \gamma\left(\bar{x} - \frac{G}{(1+\beta)}\right) < 1$ since $\gamma \in (0,1)$ and $\hat{t} > \frac{G}{\gamma(1+\beta)\bar{x}} \Rightarrow b(\breve{t}) = b(\hat{t}) > 0$. We discuss the likelihood of this majority voting equilibrium outcome in relation to the right-skewed skill distribution ($\hat{x} < \bar{x}$).

When $\hat{x} < \alpha\bar{x} < \tilde{x}$, the majority voting equilibrium results in a basic income since $\breve{t} = \hat{t} > \frac{G}{\gamma(1+\beta)\bar{x}} \Rightarrow b(\breve{t}) = b(\hat{t}) > 0$. This is consistent with median skill below the threshold ($\hat{x} < \alpha\bar{x} < \tilde{x} < \bar{x}$). This outcome is more likely when the gap between mean skill $\bar{x}$ and median skill $\hat{x}$ is large. As a result, $\hat{t}$ is consistent with $b(\hat{t}) > 0$. The following proposition summarises the majority voting equilibrium outcome when the skill distribution is skewed rightward ($\hat{x} < \bar{x}$) and the median skill level is below the threshold level ($\hat{x} < \tilde{x} < \bar{x}$).

Proposition 2 *Majority voting selects basic income when the gap between median skill $\hat{x}$ and mean skill $\bar{x}$ is large in a right-skewed distribution ($\hat{x} < \bar{x}$), for a given* *government revenue requirement and gender wage gap.*

Intuitively, households with low innate skill, and thus low earnings capacity, prefer a higher marginal income tax rate t than households with high innate skill. When the median skill level of the population is below the threshold skill level, majority voting may select a higher marginal income tax rate consistent with $b\left(t\right) > 0$. This outcome is more likely when the gap between the median and mean skill level is wide. Higher mean skill implies higher taxable average income and low median skill implies majority voting support for $b\left(\hat{t}\right) > 0$.

4. Comparative static analysis

We herein undertake a comparative static analysis to examine how parameters G, β and $\bar{x}$ affect the marginal tax rate under the basic income scheme which in turn influences female labour supply choice.

4.1. Government spending, mean productivity and gender wages

Under the basic income scheme, the average tax rate $\frac{T(y)}{y} = \breve{t} - \frac{\breve{b}}{y}$ increases as gross income y increases. Let x_L and x_H denote low and high innate productivity, respectively. If $\breve{b} > 0$ then $\frac{\breve{b}}{y(x_L)} > \frac{\breve{b}}{y(x_H)}$. For a chosen marginal income tax rate $\breve{t} = \hat{t}$, a high productivity household pays a higher average tax rate than a low productivity household, $\breve{t} - \frac{\breve{b}}{y(x_H)} > \breve{t} - \frac{\breve{b}}{y(x_L)}$. The average income tax rate becomes less progressive as the marginal tax rate $\breve{t}$ increases because $\breve{t} - \frac{\breve{b}}{y(x_H)}$ increases proportionally less than $\breve{t} - \frac{\breve{b}}{y(x_L)}$ increases.

Implicit differentiation of (15) gives

$$\frac{\partial \breve{t}}{\partial \frac{G}{(1+\beta)\bar{x}}} = \frac{\frac{G}{(1+\beta)\bar{x}}\left(1 - \frac{x}{\bar{x}}\right)\left(1 - \gamma\breve{t}\right)^3}{\left(\left(1+\beta\right)\bar{x} - G\right)^2\left(1-\gamma\right)\left(1+\gamma\breve{t}\right)} > 0 \tag{18}$$

where $\frac{G}{(1+\beta)\bar{x}} < 1$ is the government revenue requirement relative to household wages. An increase in mean innate productivity of the population $\bar{x}$ or an increase in female relative wages β would increase household wages. If the government revenue requirement relative to the mean productivity of the population $G/\bar{x}$ and β increase proportionally, $\frac{G}{(1+\beta)\bar{x}}$ increases because female wages are a portion of household wages. By equation (18), the marginal income tax rate $\check{t}$ increases. The following proposition summarises this finding.

Proposition 3 *The marginal income tax rate increases as required government revenue increases relative to mean productivity and female relative wages.*

Intuitively, an increase in required government revenue relative to mean household skill and female relative wages implies an additional tax burden. Given the selection of basic income by majority voting, it is not feasible for the government to impose more of the additional tax burden on high income earners. The government increases the marginal income tax rate $\check{t}$ and thus the average tax rate of low income relative to high income earners.

4.2. Household fertility and female labour supply

Referring to equation (3a), $\check{b} = \hat{b} > 0$ implies that a household's skill level and fertility choice are inversely related. All else equal, a couple with low innate skill would choose to have more children than a couple with high innate skill. The following proposition summarises this finding.

Proposition 4 *High skill households have fewer children than low skill households under the basic income scheme.*

Intuitively, a higher skill level x has a positive income effect and a negative substitution effect on demand for children. On the one hand, children are more affordable. On the other hand, children are more costly in terms of foregone earnings. When $b > 0$ the average income tax rate is higher for high skilled wages. A higher x raises the opportunity cost of maternal time per child, measured by foregone after-tax female wages, proportionally more than after-tax household income. The negative substitution effect outweighs the positive income effect. Thus, a household with a higher skill level x has fewer children.

Substituting in (3b) for $\check{t}$ and $b\left(\check{t}\right) > 0$, using (7), gives

$$l\left(\beta, x, \check{t}\right) = \gamma - \frac{(1-\gamma)}{\beta}\left[1 + \frac{\gamma\left(1+\beta\right)\check{t}\bar{x} - G}{\left(1-\gamma\check{t}\right)x}\right] \tag{19}$$

where $\check{t} = \hat{t}$ is the marginal income tax rate selected by a majority voting equilibrium when $\hat{x} < \alpha\bar{x} < \bar{x}$. By equation (19), the female labour supply of a household with skill level x is decreasing in $\check{t}$, where a higher $\check{t}$ means a less progressive average income tax rate. This yields the following proposition.

Proposition 5 *An increase in the marginal income tax rate under the basic income scheme reduces female labour supply of a household with a given skill level.*

Intuitively, for a given productivity level x, female earnings are lower than male earnings because of the gender wage gap $\beta < 1$ and lower female labour supply due to time spent rearing children $(1 - zn) < 1$. Under the basic income scheme, low earnings are taxed at a lower average income tax rate than high earnings. However, an increase in the marginal tax rate reduces the gap between the average tax rate on low and high income. The average income tax rate on relatively low female earnings increases, which discourages female labour supply. This raises the question addressed herein of what tax policy, in terms of functional form, can reduce the adverse effects of taxation to fund basic income.

4.3 Progressive marginal tax rate

Consider the tax function of general form

$$T(y) = \tau(y) - b \tag{20}$$

where

$$\tau'(y) > 0; \tau''(y) > 0 \tag{21}$$

under a non-linear progressive income tax system and

$$\tau(y) = ty \tag{22}$$

under a linear income tax system with constant marginal tax rate $\tau'(y) = t$. The household budget constraint is

$$y^d = c = y - \tau(y) + b \tag{23}$$

where $y = x\left(1 + \beta\left(1 - zn\right)\right)$.

The household maximises (2) subject to (23) which yields

$$\left(1 - \gamma\tau'(y)\right)\beta zn = (1 - \gamma)\left((1 + \beta) + \frac{b - \tau(y)}{x}\right) \tag{24}$$

where $n = n\left(\beta, x, b, \tau'(y)\right)$ is the solution to equation (24). Implicit differentiation of equation (24) gives

$$\frac{\partial \ln n}{\partial \ln x} = \frac{\left((1 - \gamma)\frac{(1+\beta)}{\beta zn} - 1\right)\left(1 - \tau'(y)\right) + \gamma\tau''(y)y}{1 - \tau'(y) + \tau''(y)\beta xzn} < 0 \tag{25}$$

where $\beta zn > (1 - \gamma)(1 + \beta) \Rightarrow \frac{\partial \ln n}{\partial \ln x} < 0$.

By equation (25), $\tau''(y) > 0$ introduces a feedback mechanism via the progressive marginal tax rate that attenuates the negative effect of household skill level x on fertility n. Intuitively, for a given marginal tax rate, higher wages reduce demand for children when the negative substitution effect of foregone earnings dominates the positive income effect of higher household income. The rise in female labour supply $1 - zn$ and household income $y = x\left(1 + \beta\left(1 - zn\right)\right)$ in turn raises the marginal tax rate $\tau'(y)$ which dampens the rise in after-tax female wages and thus the negative effect on fertility.

This feedback effect is absent when basic income is funded under a linear income tax system. Substituting from equation (22) for $\tau(y) = ty$ and $\tau'(y) = t$ in equation (24) gives $\beta zn = (1 - \gamma)\left[(1 + \beta) + \frac{b}{(1-t)x}\right]$ and the explicit solution for fertility (3a). Under the linear income tax system $\frac{\partial \ln n}{\partial \ln x} = (1 - \gamma)\frac{(1+\beta)}{\beta zn} - 1$ which simplifies to $\frac{\partial \ln n}{\partial \ln x} = \frac{-b}{(1+\beta)(1-t)x+b} < 0$. Thus, the negative (positive) effect of household skill on fertility (female labour supply) is less significant when basic income is funded by progressive rather than linear income taxation.

By the same logic, progressive income taxation can reduce the adverse effect on female labour supply of higher marginal tax rates to fund basic income. Higher marginal rates reduce female labour supply when the negative substitution effect of lower foregone after-tax wages dominates the positive income effect of lower disposable household income. Under progressive income taxation, the government budget constraint $\int_{x_0}^{X} \tau'(y) y\left(\beta, x, b, t\right) dF\left(x\right) - b = G$ replaces equation (6) where the marginal tax rate $\tau'(\bar{y})$ increases as average income $\bar{y} = \bar{x}\left(1 + \beta\left(1 - z\bar{n}\right)\right)$ increases with mean skill $\bar{x}$. Higher marginal tax rates can therefore be achieved through $\tau''(\bar{y}) > 0$ rather than an increase in the flat tax rate t. Thus, the increase in marginal tax rates to fund basic income is smaller under the progressive tax system, and the negative effect on female labour supply is reduced.

5. Quantitative illustrations and implications for the United States

To demonstrate the relevance of our model to present economic conditions in the US, we provide quantitative illustrations of majority voting support for basic income with an increasingly unequal wage distribution and the additional revenue required to fund basic income. Moreover, we discuss the welfare implications of basic income conditional on skill funded using the tax system as it stands.

5.1 Unequal wage distribution and voting for basic income

Figure 1 depicts the disproportionate wages growth at the top of the wage distribution for men and women in the US between 2000 and 2019. Men's real hourly wages at the 95th and 90th percentiles grew 37.1 and 19.9 percent, respectively. Median real hourly wages stagnated, increasing 3.4 percent compared with 11.9 percent at the 10th percentile. Women's real hourly wages at the 90th and 95th percentiles grew approximately twice as fast as wages at the median and 10th percentile.

[Figure 1 about here]

The mean wage, which includes outliers, has therefore increased relative to the median wage in an increasingly right-skewed wage distribution across households in the US. The median to mean wage ratio declined from 68 percent in 2000 to 66 percent in 2010, and then began to level off in 2014 towards the low of 64.9 percent in 2020 (US Bureau of Labor Statistics, 2021). Figure 2 shows the surging interest in basic income after 2014, as evidenced by usage of the term in Google relative to its peak popularity in March 2019. During the same period, basic income entered mainstream politics as democratic candidate, Andrew Yang, campaigned in the 2020 Presidential race for a "freedom dividend" of $12,000 per annum for every American adult.

[Figure 2 about here]

We parameterise equation (17) to simulate the effect of peak wage inequality on majority voting support for basic income. Parameter values are based on pre-COVID data for 2019. The median to mean wage ratio is set at $\hat{x}/\bar{x} = 0.649$ and the mean female to wage ratio is set at $\beta = 0.85$ (US Bureau of Labor Statistics, 2021). Based on mean annual household income $\bar{x}(1 + \beta(1 - zn)) = \$97,026$ and women's relative labour supply to the paid workforce $(1 - zn) = 0.8$, as proxied by female relative to male labour force participation 0.574/0.692 (US Census Bureau, 2021), the mean annual male wage for the household is set at $\bar{x} = \$57,754$ which implies mean annual aggregate wages for the household of $(1 + \beta)\bar{x} = \$106,845$.

Required government revenue per household is set at $G = \$31,656$, based on 128.6 million households and annual government spending of $\$4,071$b (billion) (Congressional Budget Office, 2020). Referring to equation (17), if $\hat{x}/\bar{x} < \alpha$ then $b\left(\check{t}\right) > 0$. Substituting for $G = \$31,656$, $(1 + \beta) = 1.85$ and $\bar{x} = \$57,754$ in $\alpha = \left(\gamma\bar{x} - \frac{G}{(1+\beta)}\right) \Big/ \gamma\left(\bar{x} - \frac{G}{(1+\beta)}\right)$ implies that the majority voting equilibrium would result in basic income for parameter values $\gamma > 0.545$. A relative utility weight for consumption above 0.55 is consistent with recent calibrations of models that incorporate leisure rather than children in the utility function to analyse the welfare implications of basic income (see Suzuki (2021)).

5.2 Basic income conditional on skill

Table 1 compares the estimated spending for three basic income schemes with the actual spending on income transfers in 2019. Although $12,000 per adult is considered sufficient to meet the basic needs of US households (Stern, 2016), the estimated spending of $3 trillion exceeds transfers spending by $460 billion. Furthermore, universal basic income (UBI) would require reform of the contribution scheme where employee contributions through payroll taxes fund Social Security retirement and Medicare. We therefore estimate the total spending of two policies consistent with retaining the US contribution scheme where basic income is limited to adults under 65 or both age-limited and conditional on below-median skill.

[Table 1 about here]

As shown in Table 1, the estimated spending on age-limited basic income phased out around the median wage is almost half of the total spending on existing transfers. Age-limited basic income conditional on skill could replace means-tested income security programs for low-income households including Medicaid, Earned Income and Child Tax Credits, unemployment compensation and the Supplemental Nutrition Assistance Program, but not Medicare and Social Security. As a result, the estimated spending of $1,225b replaces only $786b of transfers spending. This implies an additional revenue requirement of $439b, or approximately $3,400 per household.

Referring to equation (6), limiting basic income to adults under 65 years who earn less than the median wage and retaining employee contributions to fund pensions and Medicare would increase $b + G$ by $3,400. However, the left-hand side of the equality in (6) does not include the social security contributions and progressive marginal tax rates that feature in US tax policy which we now discuss.

5.3 Welfare implications

UBI discourages labour supply through higher marginal tax rates and the moral hazard that occurs when individuals can receive income without expending effort.

The theoretical results in this paper suggest that both effects are important for women as secondary earners within high skill households. Higher marginal tax rates to fund UBI reduce after-tax wages thereby inducing women to substitute time spent rearing children for paid work. Higher disposable income from UBI increases demand for children which are normal goods thereby reducing women's labour supply.

By inducing women to work less than they would choose otherwise, UBI imposes welfare losses that counteract the welfare gains from income redistribution. The optimal UBI literature is inconclusive on the overall welfare impact. Fabre et al (2017) find that UBI significantly reduces labour supply to the point that their estimated optimal UBI of $2000 barely provides any transfer and thus limited welfare gains. Islam and Colombino (2018) show that UBI enhances social welfare by redistributing income and avoiding the welfare traps of conditional transfers even if there is a reduction in labour supply.

Basic income conditional on skill avoids the punitive marginal tax rates and female labour supply disincentives under UBI by limiting eligibility to households with below-median wages and thus higher fertility and lower potential to work. There is a potential welfare gain as income is redistributed to low skill households while the reduction in female labour supply is minimised. This is consistent with simulations summarised in Fortin et al (1993) which suggest that tapering basic income as household earnings increase minimises work disincentives for married women.

The present tax system is neither linear nor nonlinear, but rather piecewise linear where marginal tax rates are constant within and increase across the income levels defining each tax bracket. A stylised two-bracket system is useful to frame our discussion of the welfare gains from funding basic income with progressive marginal tax rates. Consider the tax function

$$T(y(x_L)) = t_1 y(x_L) - b \qquad y(x_L) \leq \hat{y} \tag{26a}$$

$$T(y(x_H)) = t_2 y(x_H) + (t_1 - t_2)\hat{y} - b \qquad y(x_H) > \hat{y} \tag{26b}$$

where $\hat{y}$ is the upper income limit of the first bracket and t_1 and t_2 are the marginal tax rates in the brackets of low and high skill households, respectively. A high skill household pays a higher average tax rate than a low skill household, $t_1 - \frac{b}{y(x_L)} > t_2 + (t_1 - t_2)\frac{\hat{y}}{y(x_H)} - \frac{b}{y(x_H)}$ as $t_2 > t_1$ and $\frac{b}{y(x_L)} > \frac{b}{y(x_H)}$.

The average tax rate determines redistribution, whereas the marginal tax rate affects incentives to work and thus efficiency. The average tax rate becomes more progressive when the marginal tax rate t_2 increases to fund the increase in $b + G$. This implies an increase in equity relative to an increase in the single marginal tax rate t analysed in our model. An increase in t_2 has a negative substitution effect and positive income effect on female labour supply for high skill households. The negative income effect of basic income on female labour supply is avoided when basic income is conditional on below-median skill as $b = 0$ for high skill households. This implies an increase in efficiency. Thus, there would be an overall welfare gain from funding basic income through progressive rather than linear income taxation.

Recent modelling confirms the welfare gains from funding basic income through progressive rather than linear income taxation. Gruber and Saez (2000) develop optimal tax theory to show that piecewise linear income taxation is the most efficient and equitable way to fund basic income. Suzuki (2021) simulates welfare effects for New Zealand households by income quintiles and finds that UBI funded by a single marginal tax rate would reduce all household groups' welfare more significantly than UBI funded by progressive marginal tax rates under piecewise linear taxation.

6. Conclusion

The model presented in this paper explains the link between majority voting for basic income funded by linear income taxation, increasingly unequal distribution of skill across households and gender inequality within households. Household preference for basic income is decreasing in household skill level and female labour supply is decreasing in time spent rearing children. Adoption of the basic income scheme is determined by majority rule where the household with median skill has the decisive vote.

The analysis finds that:

1. Majority voting supports basic income as the mean skill level increases relative to median skill level across households.

2. High skilled households would have fewer children than low skilled households under the basic income scheme.

3. Proportional increases in required government revenue relative to mean skill and female relative wages increases the marginal tax rate which reduces female labour supply.

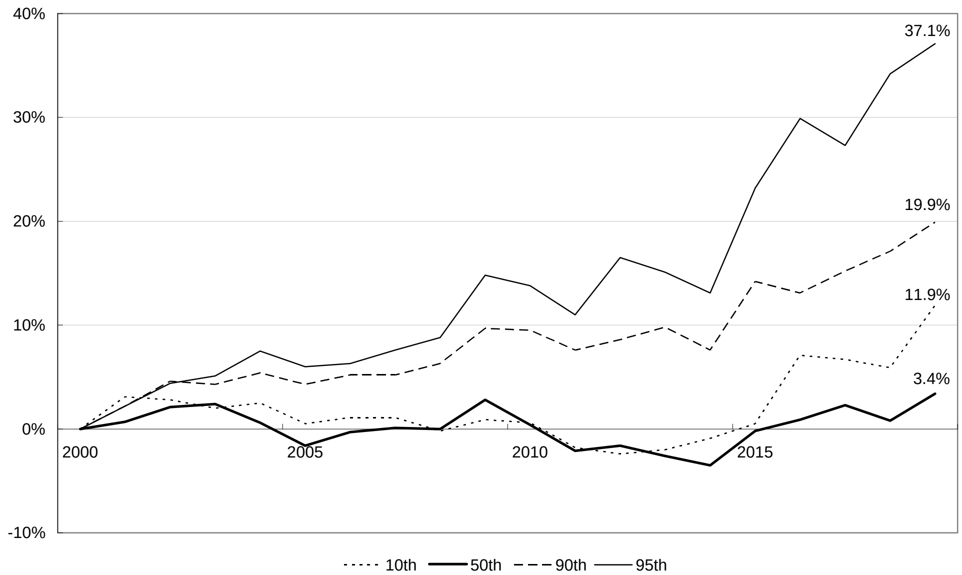
The first result explains how increasing inequality across households could lead to majority voting support for basic income. An increasingly unequal share of households at the top of the skill distribution raises the mean, while leaving the median household skill level unchanged. High mean household skill provides the taxable income to fund basic income. Low median skill provides the political support from the majority of households for the higher marginal income tax rate to fund basic income.

The second result suggests an inverse relationship between household skill and fertility under the basic income scheme. High skilled couples find children, on the one hand, more affordable, and, on the other hand, more costly in terms of foregone earnings. The latter effect dominates because the average income tax rate increases as household skill level increases under the basic income scheme. A higher skill level raises after-tax household income proportionally less than foregone female wages, thereby reducing demand for children. However, funding basic income through progressive marginal tax rates introduces a feedback mechanism that attenuates the negative effect of household skill level on fertility.

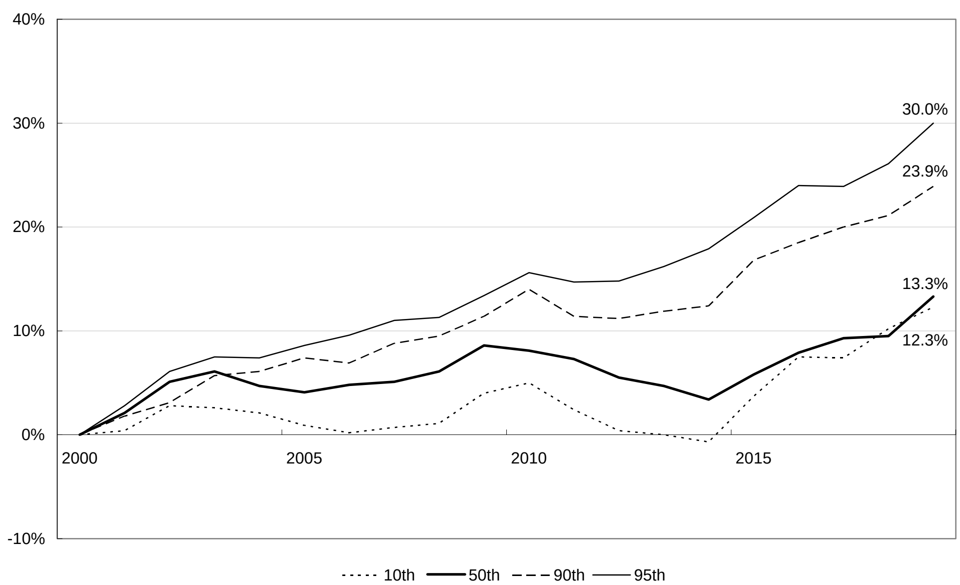
The third result identifies how the basic income scheme could exacerbate gender inequality within households. Female wages constitute a portion of taxable household income. A rise in required government revenue relative to mean skill at least proportional to a rise in female relative wages therefore implies that the government must raise the marginal income tax rate to fund basic income. The higher marginal tax rate reduces the gap between the average tax rate on low and high income. This in turn increases gender inequality because women earn less and reduce labour supply more than men.

A quantitative illustration of the model shows that the recent peak in the mean to median wage gap of 65 percent is sufficient to provide voting support for basic income from the majority of US households. We estimate that total spending for UBI of $12,000 per adult would exceed total transfers spending, whereas limiting basic income to adults under 65 years who earn less than the median wage would cost less than half of transfers spending. The conditional basic income policy is consistent with maintaining the existing contribution scheme for Social Security retirement and Medicare, and would require an increase in government revenue of $439 billion.

Basic income conditional on below-median wages funded through progressive income taxation would reduce the disincentives for female labour supply which exacerbate gender inequality within households. The punitive marginal tax rates of linear income taxation are avoided, as is the moral hazard of UBI that occurs when high skill households receive income without expending effort. There are potential welfare gains as income is redistributed to low skill households while the reduction in female labour supply is minimised. This is consistent with the findings of recent calibrated models of optimal UBI which suggest that UBI significantly reduces labour supply to the point of limited welfare gains and that funding UBI through linear rather than progressive income taxation reduces welfare.



a. Male real hourly wages by percentile, cumulative change



b. Female real hourly wages by percentile, cumulative change

Fig.1. Growth in real hourly wages, by percentile, United States, 2000-2019.

Source: US Bureau of Labor Statistics (2021)

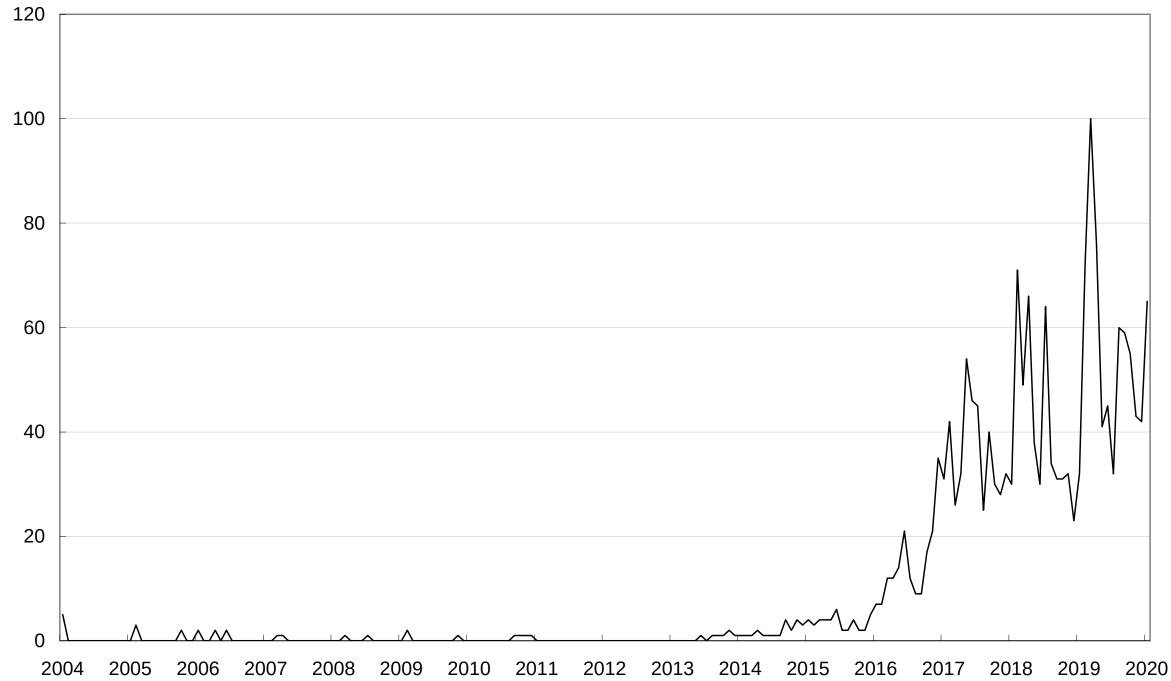


Fig. 2. Basic income search interest in Google, United States, 2004-2020. *Note*: Numbers represent search interest relative to the highest point on the chart. A value of 100 represents peak search interest in basic income.

Source: Google Trends (2022)

Table 1

Potential basic income and actual transfers spending, 2019.

Source: Congressional Budget Office (2020), author's calculations

Program	Eligibility	Total (billions)
Basic income $12,000		
Universal	Ages 18+	$3,062.4
Age limited	Ages 18-64	$2,450.4
Conditional on skill level	Ages 18-64, below median wage	$1,225
Existing transfers		$2,599
excluding Medicare*	*65+ or disabled	$1824
excluding Medicare, Social Security	†65+ with work history (WH)	
retirement†, survivors‡ and disability	‡Survivors of deceased with WH	$786

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